What is Claimed is:

1. An arrangement for wavelength locking each of a single or plurality of radiation sources that generate separate wavelength output signals, the arrangement comprising:

a multiplexing/demultiplexing grating device for receiving the separate wavelength output signals from the plurality of radiation sources and generating a multiplexed wavelength output signal from the arrangement at a zero diffraction order output port of the grating device, and symmetric wavelength+δ and wavelength-δ output signals for each radiation source that are resolved at at least one separate predetermined location of a non-zero diffraction order of the grating device;

a plurality of radiation detectors, each radiation detector being coupled to receive a separate one of the symmetric wavelength+δ and wavelength-δ output signals from a separate one of the plurality of radiation sources, and to generate an output signal representing the magnitude of the received wavelength output signal; and

a control device responsive to output signals from each pair of radiation detectors that are coupled to receive the separate wavelength+δ and wavelength-Š output signals from a separate predetermined one of the plurality of radiation sources, for utilizing a signal ratio of the separate wavelength+δ and wavelength-δ output signals and generating therefrom a separate output control signal to each one of the plurality of radiation

sources for locking the separate wavelength output signal thereof to a desired wavelength value.

2. The wavelength locking arrangement of claim 1 wherein the multiplexing/demultiplexing grating device is formed from one of a group consisting of an Array Waveguide Grating, a bulk grating, and an Echelle grating.

3. The wavelength locking arrangement of claim 1 wherein the multiplexing/demultiplexing grating device is an Array Waveguide Grating comprising:

a first Free Propagation Region (FPR) for receiving the separate wavelength output signals from the plurality of radiation sources at an input side thereof;

a second FPR comprising an input and an output side thereof; and

a grating array comprising a plurality of different-length optical waveguides coupling the output side of the first FPR and the input side of the second FPR for causing the second FPR to generate the multiplexed wavelength output signal from the plurality of radiation sources at the zero diffraction order output port at the output side thereof, and resolving the separate wavelength+δ and wavelength-δ output signals at separate predetermined locations of at least one predetermined non-zero diffraction order output at the output side thereof.

4. The wavelength locking arrangement of claim 3 wherein the separate wavelength+δ and wavelength-δ output signals from all of the plurality of radiation sources are resolved at

separate predetermined locations within a single predetermined non-zero diffraction order output area.

5. The wavelength locking arrangement of claim 3 wherein the separate wavelength+δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area, and wavelength-δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a different single predetermined non-zero diffraction order output area.

6. The wavelength locking arrangement of claim 1 wherein the multiplexing/demultiplexing grating device is an Array Waveguide Grating comprising:

a first Free Propagation Region (FPR) for receiving the separate wavelength output signals from the plurality of radiation sources at an input side thereof;

a second FPR comprising an input and an output side thereof, the output side comprising a feedback loop between a predetermined non-zero diffraction order output and an anti-order output; and

a grating array comprising a plurality of different-length optical waveguides coupling the output side of the first FPR and the input side of the second FPR for causing the second FPR to generate the multiplexed wavelength output signal from the plurality of radiation sources at the zero diffraction order output and a predetermined non-zero diffraction order output, and the separate wavelength+δ and wavelength-δ output signals are

resolved at separate predetermined locations at the input side of the first FPR that are separate from the locations of the inputs from the plurality of radiation sources after being fed back through the second FPR, the grating array, and the first FPR.

7. The wavelength locking arrangement of claim 1 wherein the control device compares the output signals from each pair of radiation detectors coupled to receive the separate wavelength+δ and wavelength-δ output signals from a separate predetermined radiation source for detecting a wavelength shift in the predetermined radiation source and generating an output control signal to the predetermined radiation source in response to a detected wavelength shift for changing one of a group consisting of a current and a temperature of the predetermined radiation source for locking the wavelength thereof.

8. An optical device comprising:

a plurality of radiation sources each for radiating light of a different assigned wavelength; and

means for locking the wavelength of the radiation sources to the assigned value comprising:

a multiplexing/demultiplexing grating device for receiving the separate wavelength output signals from the plurality of radiation sources and generating a multiplexed wavelength output signal from the arrangement at a zero diffraction order output port of the grating device, and symmetric wavelength+δ and wavelength-δ output signals for each radiation source that are resolved at separate predetermined locations of a non-zero diffraction order of the grating device;

a plurality of radiation detectors, each radiation detector being coupled to receive a separate one of the symmetric wavelength+δ and wavelength-δ output signals from a separate one of the plurality of radiation sources, and to generate an output signal representing the magnitude of the received wavelength output signal; and

a control device responsive to output signals from each pair of radiation detectors that are coupled to receive the separate wavelength+δ and wavelength-δ output signals from a separate predetermined one of the plurality of radiation sources, for utilizing a signal ratio of the separate wavelength+δ and wavelength-δ output signals and generating therefrom a separate output control signal to each one of the plurality of radiation sources for locking the separate wavelength output signal thereof to a desired wavelength value.

9. The optical device of claim 8 wherein the multiplexing/demultiplexing grating device of the wavelength locking means is formed from one of a group consisting of an Array Waveguide Grating, a bulk grating, and a Echelle grating.

10. The optical device of claim 8 wherein the multiplexing/demultiplexing grating device of the wavelength locking means is an Array Waveguide Grating comprising:

a first Free Propagation Region (FPR) for receiving the separate wavelength output signals from the plurality of radiation sources at an input side thereof;

a second FPR comprising an input and an output side thereof; and

a grating array comprising a plurality of differently spaced optical waveguides coupling the output side of the first FPR and the input side of the second FPR for causing the second FPR to generate the multiplexed wavelength output signal from the plurality of radiation sources at the zero diffraction order output port at the output side thereof, and resolving the separate symmetric wavelength+δ and wavelength-δ output signals at separate predetermined locations of at least one predetermined non-zero diffraction order output at the output side thereof.

11. The optical device of claim 10 wherein, in the wavelength locking means, the separate symmetric wavelength+δ and wavelength-δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area.

12. The optical device of claim 10 wherein in the wavelength locking means, the separate wavelength+δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area on a first side of the zero diffraction order port, and wavelength-δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area on a second opposite side of the zero diffraction order port.

13. The optical device of claim 8 wherein the multiplexing/demultiplexing grating device of the wavelength locking means is an Array Waveguide Grating comprising:

a first Free Propagation Region (FPR) for receiving the separate wavelength output signals from the plurality of radiation sources at an input side thereof;

a second FPR comprising an input and an output side thereof, the output side comprising a feedback loop between a non-zero diffraction order output and an anti-order output; and

a grating array comprising a plurality of differently spaced optical waveguides coupling the output side of the first FPR and the input side of the second FPR for causing the second FPR to generate the multiplexed wavelength output signal from the plurality of radiation sources at the zero diffraction order output and at the predetermined non-zero diffraction order outputs, and resolving the separate symmetric wavelength+δ and wavelength-δ output signals at separate predetermined locations at the input side of the first FPR that are separate from the locations of the inputs from the plurality of radiation sources after being fed back through the second FPR, the grating array, and the first FPR.

14. The optical device of claim 8 wherein the control device of the wavelength locking means compares the output signals from each pair of radiation detectors coupled to receive the separate symmetric wavelength+δ and wavelength-δ output signals from a separate predetermined radiation source for detecting a wavelength shift in the predetermined radiation

source and generating an output control signal to the predetermined radiation source in response to a detected wavelength shift for changing one of a group consisting of a current and a temperature of the predetermined radiation source for locking the wavelength thereof.

15. A method of wavelength locking each of a plurality of radiation sources that generate separate wavelength output signals comprising the steps of:

(a) receiving the wavelength output signals from the plurality of radiation sources in a multiplexing/demultiplexing grating device for generating a multiplexed wavelength output signal at a zero diffraction order output port of the grating device, and generating separate symmetric wavelength+δ and wavelength-δ output signals for each radiation source that are resolved at separate predetermined locations of a predetermined non-zero diffraction order of the grating device;

(b) receiving each one of the symmetric wavelength+δ and wavelength-δ output signals from the plurality of radiation sources at a separate one of a plurality of radiation detectors;

(c) generating an output signal at each radiation detector representing the magnitude of the received wavelength output signal; and

(d) generating separate output control signals from a control device in response to the output signals from each pair of radiation detectors that are coupled to receive the separate symmetric wavelength+δ and wavelength-δ output signals from a

separate predetermined radiation source for locking the wavelength of each of the predetermined radiation sources.

16. The method of claim 15 wherein in performing step (a), performing the substeps of:

(a1) receiving the separate wavelength output signals from the plurality of radiation sources at an input side of a first Free Propagation Region (FPR); and

(a2) propagating the wavelength output signals from the plurality of radiation sources through the first FPR, a second FPR, and a grating array comprising a plurality of differently spaced optical waveguides coupling an output side of the first FPR and an input side of the second FPR for causing the second FPR to generate the multiplexed wavelength output signal from the plurality of radiation sources at a zero diffraction order output port, and the separate symmetric wavelength+δ and wavelength-δ output signals at separate predetermined locations of at least one predetermined non-zero diffraction order output at the output side thereof.

17. The method of claim 16 wherein in step (a2), the separate symmetric wavelength+δ and wavelength-δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area.

18. The method of claim 16 wherein in step (a2), the separate wavelength+δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction

order output area on a first side of the zero diffraction order port, and the wavelength-δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area on a second opposite side of the zero diffraction order port.

19. The method of claim 15 wherein in performing step (a), performing the substeps of:

(a1) receiving the separate wavelength output signals from the plurality of radiation sources at an input side of a first Free Propagation Region (FPR);

(a2) propagating the wavelength output signals from the plurality of radiation sources through the first FPR, a second FPR, and a grating array comprising a plurality of differently spaced optical waveguides coupling an output side of the first FPR and an input side of the second FPR for causing the second FPR to generate the multiplexed wavelength output signal from the plurality of radiation sources at a zero diffraction order output port and at a predetermined non-zero diffraction order output;

(a3) feeding the multiplexed wavelength output signal back into the second FPR via a feedback loop coupling the predetermined non-zero diffraction order output and the anti-order output; and

(a4) recovering the separate symmetric wavelength+δ and wavelength-δ output signals that are resolved at separate predetermined locations at the input side of the first FPR that are separate from the locations of the inputs from the plurality

of radiation sources after being fed back through the second FPR, the grating array, and the first FPR.

20. The method of claim 15 wherein in performing step (d), performing the substeps of:

(c1) comparing the output signals from each pair of radiation detectors that are coupled to receive the separate wavelength+δ and wavelength-δ output signals from a separate predetermined radiation source in the control device;

(c2) detecting a wavelength shift in the predetermined radiation source in response to the received wavelength+δ and wavelength-δ output signals; and

(c3) generating an output control signal to the predetermined radiation source in response to a detected wavelength shift for changing one of a group consisting of a current and a temperature of the predetermined radiation source for locking the wavelength thereof.

21. A method of wavelength locking a plurality of wavelengths generated by a corresponding plurality of radiation sources of an optical device comprising the steps of:

(a) receiving the wavelength output signals from the plurality of radiation sources in a multiplexing/demultiplexing grating device for generating a multiplexed wavelength output signal at a zero diffraction order output port of the grating device, and generating separate symmetric wavelength+δ and wavelength-δ output signals for each radiation source that are resolved at separate predetermined locations of a predetermined non-zero diffraction order of the grating device;

(b) receiving each one of the symmetric wavelength+δ and wavelength-δ output signals from the plurality of radiation sources at a separate one of a plurality of radiation detectors;

(c) generating an output signal at each radiation detector representing the magnitude of the received wavelength output signal; and

(d) generating separate output control signals from a control device in response to the output signals from each pair of radiation detectors that are coupled to receive the separate symmetric wavelength+δ and wavelength-δ output signals from a separate predetermined radiation source for locking the wavelength of each of the predetermined radiation sources.

22. The method of claim 21 wherein in performing step (a), performing the substeps of:

(a1) receiving the separate wavelength output signals from the plurality of radiation sources at an input side of a first Free Propagation Region (FPR); and

(a2) propagating the wavelength output signals from the plurality of radiation sources through the first FPR, a second FPR, and a grating array comprising a plurality of differently spaced optical waveguides coupling an output side of the first FPR and an input side of the second FPR for causing the second FPR to generate the multiplexed wavelength output signal from the plurality of radiation sources at a zero diffraction order output port, and the separate symmetric wavelength+δ and wavelength-δ output signals at separate predetermined locations of at least

one predetermined non-zero diffraction order output at the output side thereof.

23. The method of claim 22 wherein in step (a2), the separate symmetric wavelength+δ and wavelength-δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area.

24. The method of claim 22 wherein in step (a2), the separate wavelength+δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area on a first side of the zero diffraction order port, and the wavelength-δ output signals from all of the plurality of radiation sources are resolved at separate predetermined locations within a single predetermined non-zero diffraction order output area on a second opposite side of the zero diffraction order port.

25. The method of claim 21 wherein in performing step (a), performing the substeps of:

(a1) receiving the separate wavelength output signals from the plurality of radiation sources at an input side of a first Free Propagation Region (FPR);

(a2) propagating the wavelength output signals from the plurality of radiation sources through the first FPR, a second FPR, and a grating array comprising a plurality of differently spaced optical waveguides coupling an output side of the first FPR and an input side of the second FPR for causing the second

FPR to generate the multiplexed wavelength output signal from the plurality of radiation sources at a zero diffraction order output port and a predetermined non-zero diffraction order output;

(a3) feeding the multiplexed wavelength output signal back into the second FPR via a feedback loop coupling the predetermined non-zero diffraction order output and the anti-order output; and

(a4) recovering the separate symmetric wavelength+δ and wavelength-δ output signals that are resolved at separate predetermined locations at the input side of the first FPR that are separate from the locations of the inputs from the plurality of radiation sources after being fed back through the second FPR, the grating array, and the first FPR.

26. The method of claim 21 wherein in performing step (d), performing the substeps of:

(c1) comparing the output signals from each pair of radiation detectors that are coupled to receive the separate wavelength+δ and wavelength-δ output signals from a separate predetermined radiation source in the control device;

(c2) detecting a wavelength shift in the predetermined radiation source in response to the received wavelength+δ and wavelength-δ output signals; and

(c3) generating an output control signal to the predetermined radiation source in response to a detected wavelength shift for changing one of a group consisting of a current and a temperature of the predetermined radiation source for locking the wavelength thereof.